

CONTRACT FOR WATER QUALITY MODELING SERVICES
IN THE NORTHEAST CREEK WATERSHED

This contract is dated, made, and entered into as of the _____ day of August, 2012, by the City of Durham ("City") and Tetra Tech, Inc. ("Contractor"), a corporation organized and existing under the laws of Delaware and registered to conduct business in the State of North Carolina.

Sec. 1. Background and Purpose. The Public Works Department, Stormwater Services Division is seeking to develop new water quality models and enhance the Northeast Creek hydrologic model. As part of the watershed implementation plan (WIP), a watershed model has been built using PCSWMM, a spatial decision support system for USEPA's storm water management model version 5 (SWMM 5). Water Quality modeling component needs to be added to the existing model. A separate water quality model, Water Quality Analysis Simulation Program (WASP), will also be developed as part of this contract for adequately modeling dissolved oxygen (DO). Stormwater Services anticipates that this information can be readily utilized for future regulatory uses such as development of a third-party total maximum daily load (TMDL). The water quality constituents/parameters of concern for the purpose of this project are dissolved oxygen, turbidity, copper, zinc, total nitrogen (organic and inorganic), and total phosphorus.

As part of this contract, Stormwater Services will also upgrade the existing Watershed and Risk Management Framework (WARMF), developed by NCDWQ in 2009. A number of improvements to the model are desired to make the model more representative of the spatial distribution of City loads and to isolate Durham City/County nutrient loads from those of neighboring counties.

Sec. 2. Services and Scope to be Performed. Presumption that Duty is Contractor's. The Contractor shall provide watershed modeling services, attend and document meetings, prepare reports, meet deadlines for all tasks, and participate in regular project meetings with the City and NCDWQ. The detailed tasks and deliverables for the work to be performed are provided in Exhibit A, "Scope of Services."

In this contract, "Work" means the services that the Contractor is required to perform pursuant to this contract and all of the Contractor's duties to the City that arise out of this contract. Unless the context requires otherwise, if this contract states that a task is to be performed or that a duty is owed, it shall be presumed that the task or duty is the obligation of the Contractor.

Sec. 3. Schedule of Performance and Term. This Contract will be effective upon execution by both parties and will expire upon completion of the services and payment by the City, no later than May 31, 2013. A detailed schedule is available as Exhibit B. The key team members proposed by the contractor to work on this project are listed as part of Exhibit C. The Contractor may not substitute these key personnel or alter their responsibilities in performing the Work under this Contract without prior written authorization from the City.

Sec. 4. Complete Work without Extra Cost. Except to the extent otherwise specifically stated in this contract, the Contractor shall obtain and provide, without additional cost to the City, all labor, materials, equipment, transportation, facilities, services, permits, and licenses necessary to perform the Work.

Sec. 5. Contractor's Billings to City. Compensation. The Contractor shall send invoices to the City on a monthly basis for the amounts to be paid pursuant to this contract. Each invoice shall document, to the reasonable satisfaction of the City: work performed under each task described in the Scope of Work (Exhibit A). A monthly status report shall accompany each invoice, which summarizes the work progress, updated schedule, and a description of any contract issues and their resolution. Within twenty days after the City receives an invoice, the City shall send the Contractor a check in payment for

all undisputed amounts contained in the invoice.

The City shall pay the Contractor for the Work on a time and materials basis not to exceed the total amount of \$227,108.00. The City shall not be obligated to pay the Contractor any payments, fees, expenses, or compensation other than those authorized by this section.

Sec. 6. Prompt Payment to Subcontractors. (a) Within 7 days of receipt by the Contractor of each payment from the City under this contract, the Contractor shall pay all Subcontractors (which term includes subconsultants and suppliers) based on work completed or service provided under the subcontract. Should any payment to the Subcontractor be delayed by more than 7 days after receipt of payment by the Contractor from the City under this contract, the Contractor shall pay the Subcontractor interest, beginning on the 8th day, at the rate of 1% per month or fraction thereof on such unpaid balance as may be due. By appropriate litigation, Subcontractors shall have the right to enforce this subsection (a) directly against the Contractor, but not against the City of Durham.

(b) If the individual assigned to administer this contract for the City (in this section, titled "Prompt Payment to Subcontractors," he or she will be referred to as the "Project Manager") determines that it is appropriate to enforce subsection (a) in this manner, the City may withhold from progress or final payments to the Contractor the sums estimated by the Project Manager to be

- (i) the amount of interest due to the Subcontractor under subsection (a), and/or
- (ii) the amounts past-due under subsection (a) to the Subcontractor but not exceeding 5% of the payment(s) due from the City to the Contractor.

This subsection (b) does not limit any other rights to withhold payments that the City may have.

(c) Nothing in this section (titled "Prompt Payment to Subcontractors") shall prevent the Contractor at the time of invoicing, application, and certification to the City from withholding invoicing, application, and certification to the City for payment to the Subcontractor for unsatisfactory job progress; defective goods, services, or construction not remedied; disputed work; third-party claims filed or reasonable evidence that such a claim will be filed; failure of the subcontractor to make timely payments for labor, equipment, and materials; damage to the Contractor or another subcontractor; reasonable evidence that the subcontract cannot be completed for the unpaid balance of the subcontract sum; or a reasonable amount for retainage not to exceed 10%.

(d) The Project Manager may require, as a prerequisite to making progress or final payments, that the Contractor provide statements from any Subcontractors designated by the Project Manager regarding the status of their accounts with the Contractor. The statements shall be in such format as the Project Manager reasonably requires, including notarization if so specified.

Sec. 7. Insurance.

Insurance Requirement –Architect/Engineer Design Services for Watershed Modeling Project

Contractor shall maintain insurance not less than the following:

Commercial General Liability, covering

- premises/operations
- products/completed operations
- broad form property damage
- explosion, collapse, and underground hazards if the hazards exist in the performance of this contract
- contractual liability
- independent contractors, if any are used in the performance of this contract
- City of Durham must be named additional insured, and an original of the endorsement to effect the coverage must be attached to the certificate (if by blanket endorsement, then agent may so indicate in the GL section of the certificate, in lieu of an original endorsement)

- combined single limit not less than \$1,000,000 per occurrence; aggregate limit not less than \$2,000,000 per year

Professional Liability, covering

- engineers and architects (employed or engaged by Contractor)
- covering claims arising out of design work, calculations and estimates, and any other professional services performed in connection with this contract
- self-insured retentions/deductibles in excess of \$50,000 must be approved by City Finance Director
- coverage may be provided either by specific policy or as part of the Commercial General Liability Policy
- combined single limit not less than \$1,000,000 per claim; aggregate limit not less than \$2,000,000 per year

Workers' Compensation Insurance, covering

- statutory benefits;
- covering employees; covering owners partners, officers, and relatives (who work on this contract); certificate must specifically state who is covered by the policy
- employers' liability, \$1,000,000.

Insurance shall be provided by:

- companies authorized to do business in the State of North Carolina
- companies with Best rating of A-VIII or better.

Insurance shall be evidenced by a certificate:

- providing notice to the City of not less than 30 days prior to cancellation or reduction of coverage
- certificates shall be addressed to:
City of Durham, North Carolina
Attention: Public Works Department
101 City Hall Plaza
Durham, NC 27701

the insurance certificate must be approved by the City's Finance Director before Contractor can begin any work under this contract

Sec. 8. Performance of Work by City. If the Contractor fails to perform the Work in accordance with the schedule referred to in section 3 above, the City may, in its discretion, in order to bring the project closer to the schedule, perform or cause to be performed some or all of the Work, and doing so shall not waive any of the City's rights and remedies. Before doing so, the City shall give the Contractor notice of its intention. The Contractor shall reimburse the City for additional costs incurred by the City in exercising its right to perform or cause to be performed some or all of the Work pursuant to this section.

Sec. 9. Exhibits. The following exhibits are made a part of this contract:

Exhibit A *Scope of Work for Northeast Creek Watershed Modeling Services, containing 5 pages*

Exhibit B *Project Schedule, containing 1 page*

Exhibit C *Project Team and Key Personnel, containing 1 page*

Sec. 10. Notice. (a) All notices and other communications required or permitted by this contract shall be in writing and shall be given either by personal delivery, fax, UPS, Federal Express, or certified United States mail, return receipt requested, addressed as follows. The parties are requested to send a copy by email.

To the City:

Sujit Ekka

Stormwater Services Division

City of Durham

101 City Hall Plaza

Durham, NC 27701-3329

The fax number is (919)-560-4316

Email: sujit.ekka@durhamnc.gov

To the Contractor:

Trevor Clements

Tetra Tech, Inc.

3200 Chapel Hill-Nelson Highway

Suite 105, Cape Fear Bldg

P.O. Box 14409

The fax number is 919-485-8278

Email: trevor.clements@tetrattech.com

(b) Change of Address. Date Notice Deemed Given. A change of address, fax number, or person to receive notice may be made by either party by notice given to the other party. Any notice or other communication under this contract shall be deemed given and sent at the time of actual delivery, if it is personally delivered or sent by fax. If the notice or other communication is sent by United States mail, it shall be deemed given upon the third calendar day following the day on which such notice or other communication is deposited with the United States Postal Service or upon actual delivery, whichever first occurs.

Sec. 11. Indemnification. (a) To the maximum extent allowed by law, the Contractor shall defend, indemnify, and save harmless Indemnitees from and against all Charges that arise in any manner from, in connection with, or out of this contract as a result of acts or omissions of the Contractor or subcontractors or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable. In performing its duties under this subsection "a," the Contractor shall at its sole expense defend Indemnitees with legal counsel reasonably acceptable to City. (b) Definitions. As used in subsections "a" above and "c" below -- "Charges" means claims, judgments, costs, damages, losses, demands, liabilities, duties, obligations, fines, penalties, royalties, settlements, and expenses (included without limitation within "Charges" are (1) interest and reasonable attorneys' fees assessed as part of any such item, and (2) amounts for alleged violations of sedimentation pollution, erosion control, pollution, or other environmental laws, regulations, ordinances, rules, or orders -- including but not limited to any such alleged violation that arises out of the handling, transportation, deposit, or delivery of the items that are the subject of this contract). "Indemnitees" means City and its officers, officials, independent contractors, agents, and employees, excluding the Contractor. (c) Other Provisions Separate. Nothing in this section shall affect any warranties in favor of the City that are otherwise provided in or arise out of this contract. This section is in addition to and shall be construed separately from any other indemnification provisions that may be in this contract. (d) Survival. This section shall remain in force despite termination of this contract (whether by expiration of the term or otherwise) and termination of the services of the Contractor under this contract. (e) Limitations of the Contractor's Obligation. If this section is in, or is in connection with, a contract relative to the design, planning, construction, alteration, repair or maintenance of a building, structure, highway, road, appurtenance or appliance, including moving, demolition and excavating connected therewith, then subsection "a" above shall not require the Contractor to indemnify or hold harmless Indemnitees against liability for damages arising out of bodily injury to persons or damage to property proximately caused by or resulting from the negligence, in whole or in part, of Indemnitees.

Sec. 12. Miscellaneous

(a) Choice of Law and Forum; Service of Process. (i) This contract shall be deemed made in Durham County, North Carolina. This contract shall be governed by and construed in accordance with the law of North Carolina. The exclusive forum and venue for all actions arising out of this contract shall be the North Carolina General Court of Justice, in Durham County. Such actions shall neither be commenced in nor removed to federal court. This subsection (a) shall not apply to subsequent actions to enforce a judgment entered in actions heard pursuant to this subsection. (ii) If the Contractor is not a natural person (for instance, the Contractor is a corporation or limited liability company), this subsection (ii) applies. "Agent for Service of Process" means every person now or hereafter appointed by the Contractor to be served or to accept service of process in any State of the United States. Without excluding any other method of service authorized by law, the Contractor agrees that every Agent for Service of Process is designated as its non-exclusive agent for service of process, summons, and complaint. The Contractor will instruct each Agent for Service of Process that after such agent receives the process, summons, or complaint, such agent shall promptly send it to the Contractor. This subsection (ii) does not apply while the Contractor maintains a registered agent in North Carolina with the office of the N. C. Secretary of State and such registered agent can be found with due diligence at the registered office.

(b) Waiver. No action or failure to act by the City shall constitute a waiver of any of its rights or remedies that arise out of this contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

(c) Performance of Government Functions. Nothing contained in this contract shall be deemed or construed so as to in any way estop, limit, or impair the City from exercising or performing any regulatory, policing, legislative, governmental, or other powers or functions.

(d) Severability. If any provision of this contract shall be unenforceable, the remainder of this contract shall be enforceable to the extent permitted by law.

(e) Assignment. Successors and Assigns. Without the City's written consent, the Contractor shall not assign (which includes to delegate) any of its rights (including the right to payment) or duties that arise out of this contract. The City Manager may consent to an assignment without action by the City Council. Unless the City otherwise agrees in writing, the Contractor and all assignees shall be subject to all of the City's defenses and shall be liable for all of the Contractor's duties that arise out of this contract and all of the City's claims that arise out of this contract. Without granting the Contractor the right to assign, it is agreed that the duties of the Contractor that arise out of this contract shall be binding upon it and its heirs, personal representatives, successors, and assigns.

(f) Compliance with Law. In performing all of the Work, the Contractor shall comply with all applicable law.

(g) Notice of City Policy. THE CITY OPPOSES DISCRIMINATION ON THE BASIS OF RACE AND SEX AND URGES ALL OF ITS CONTRACTORS TO PROVIDE A FAIR OPPORTUNITY FOR MINORITIES AND WOMEN TO PARTICIPATE IN THEIR WORK FORCE AND AS SUBCONTRACTORS AND VENDORS UNDER CITY CONTRACTS.

(h) EEO Provisions. During the performance of this Contract the Contractor agrees as follows: (1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, political affiliation or belief, age, or handicap. The Contractor shall take affirmative action to insure that applicants are employed and that employees are treated equally during employment, without regard to race, color, religion, sex, national origin, political affiliation or belief, age, or handicap. Such action shall include but not be limited to the following: employment, upgrading, demotion, transfer, recruitment or advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. The Contractor shall post in conspicuous places, available to employees and applicants for employment, notices setting forth these EEO provisions. (2) The Contractor shall in all solicitations or advertisement for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, political affiliation or belief, age, or handicap. (3) The Contractor shall send a copy of the

EEO provisions to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding. (4) In the event of the Contractor's noncompliance with these EEO provisions, the City may cancel, terminate, or suspend this contract, in whole or in part, and the City may declare the Contractor ineligible for further City contracts. (5) Unless exempted by the City Council of the City of Durham, the Contractor shall include these EEO provisions in every purchase order for goods to be used in performing this contract and in every subcontract related to this contract so that these EEO provisions will be binding upon such subcontractors and vendors.

(i) SDBE. The Contractor shall comply with all applicable provisions of Article III of Chapter 18 of the Durham City Code (Equal Business Opportunities Ordinance), as amended from time to time. The failure of the Contractor to comply with that article shall be a material breach of contract which may result in the rescission or termination of this contract and/or other appropriate remedies in accordance with the provisions of that article, this contract, and State law. The Participation Plan submitted in accordance with that article is binding on the Contractor. Section 18-59(f) of that article provides, in part, "If the City Manager determines that the Contractor has failed to comply with the provisions of the Contract, the City Manager shall notify the Contractor in writing of the deficiencies. The Contractor shall have 14 days, or such time as specified in the Contract, to cure the deficiencies or establish that there are no deficiencies." It is stipulated and agreed that those two quoted sentences apply only to the Contractor's alleged violations of its obligations under Article III of Chapter 18 and not to the Contractor's alleged violations of other obligations.

(j) No Third Party Rights Created. This contract is intended for the benefit of the City and the Contractor and not any other person.

(k) Principles of Interpretation and Definitions. (1) The singular includes the plural and the plural the singular. The pronouns "it" and "its" include the masculine and feminine. References to statutes or regulations include all statutory or regulatory provisions consolidating, amending, or replacing the statute or regulation. References to contracts and agreements shall be deemed to include all amendments to them. The words "include," "including," etc. mean include, including, etc. without limitation. (2) References to a "Section" or "section" shall mean a section of this contract. (3) "Contract" and "Agreement," whether or not capitalized, refer to this instrument. (4) "Duties" includes obligations. (5) The word "person" includes natural persons, firms, companies, associations, partnerships, trusts, corporations, governmental agencies and units, and other legal entities. (6) The word "shall" is mandatory. (7) The word "day" means calendar day. (8) The word "Work" is defined in Section 2. (9) A definition in this contract will not apply to the extent the context requires otherwise.

(l) Modifications. Entire Agreement. A modification of this contract is not valid unless signed by both parties and otherwise in accordance with requirements of law. Further, a modification is not enforceable against the City unless it is signed by the City Manager, a deputy or assistant City Manager, or, in limited circumstances, a City department director. This contract contains the entire agreement between the parties pertaining to the subject matter of this contract. With respect to that subject matter, there are no promises, agreements, conditions, inducements, warranties, or understandings, written or oral, expressed or implied, between the parties, other than as set forth or referenced in this contract.

(m) City's Manager's Authority. To the extent, if any, the City has the power to suspend or terminate this contract or the Contractor's services under this contract, that power may be exercised by City Manager or a deputy or assistant City Manager without City Council action.

Sec. 13. Termination for Convenience ("TFC"). (a) *Procedure*. Without limiting any party's right to terminate for breach, the parties agree that the City may, without cause, and in its discretion, terminate this contract for convenience by giving the Contractor written notice that refers to this section. TFC shall be effective at the time indicated in the notice. (b) *Obligations*. Upon TFC, all obligations that are still executory on both sides are discharged except that any right based on prior breach or performance survives, and the indemnification provisions and the section of this contract titled Trade Secrets and Confidentiality, if any, shall remain in force. At the time of TFC or as soon afterwards as is practical, the Contractor shall give the City all Work, including partly completed Work. In case of TFC, the Contractor

shall follow the City's instructions as to which subcontracts to terminate. (c) *Payment*. The City shall pay the Contractor an equitable amount for the costs and charges that accrue because of the City's decisions with respect to the subcontracts, but excluding profit for the Contractor. Within 20 days after TFC, the City shall pay the Contractor one hundred dollars as a TFC fee and shall pay the Contractor for all Work performed except to the extent previously paid for. Work shall be paid for in accordance with the method (unit prices, hourly fees, etc.) to be used for payment had the Work been completed except to the extent it would be inequitable to either party, and if Work was to be paid for on a lump-sum basis, the City shall pay the part of the lump sum that reflects the percentage of completion attained for that Work. The Contractor shall not be entitled to any payment because of TFC except as stated in this section, whether on the basis of overhead, profit, damages, other economic loss, or otherwise.

Sec. 14. Trade Secrets; Confidentiality. The request for proposals (RFP) section titled "Trade Secrets and Confidentiality" shall apply to any Trade Secrets disclosed to the City during the process leading to the parties' entering into this Contract (including all of the Contractor's responses to the RFP). This section (titled "Trade Secrets; Confidentiality") shall remain in force despite termination of this contract (whether by expiration of the term or otherwise) and termination of the services of the Contractor under this contract. For purposes of this contract, the word "candidate" in the RFP section just cited shall mean the "Contractor."

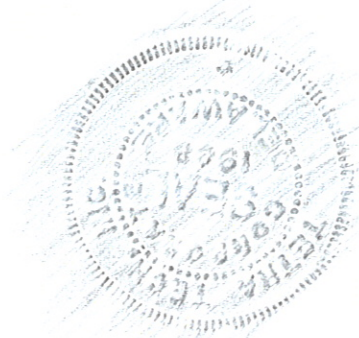
IN WITNESS WHEREOF, the City and the Contractor have caused this contract to be executed under seal themselves or by their respective duly authorized agents or officers.

ATTEST:

CITY OF DURHAM

_____ By: _____

preaudit certificate, if applicable _____



TETRA TECH, INC.

By: Ganis B. Salia

Title of officer: Senior V.P., General Counsel & Secretary

(Affix corporate seal.)

State of _____ ACKNOWLEDGMENT BY TETRA TECH, INC.

County of _____

see attached C.I.

I, a notary public in and for the aforesaid county and state, certify that

_____ personally appeared before me this day and stated that he or she is (*strike through the inapplicable:*) chairperson/ president/ chief executive officer/ vice-president/ assistant vice-president/ treasurer/ chief financial officer of TETRA TECH, INC., a corporation, and that by authority duly given and as the act of the corporation, he or she signed the foregoing contract or agreement with the City of Durham and the corporate seal was affixed thereto. This the _____ day of _____, 20_____.

My commission expires:

Notary Public

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT

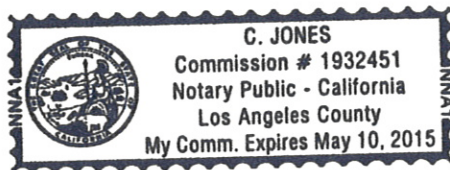
CIVIL CODE § 1189

State of California

County of LOS ANGELES

On 06/14/12 before me, C. JONES, NOTARY PUBLIC,
Date Here Insert Name and Title of the Officer

personally appeared JANIS B. SALIN
Name(s) of Signer(s)



who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/~~are~~ subscribed to the within instrument and acknowledged to me that he/~~she/they~~ executed the same in his/~~her/their~~ authorized capacity(ies), and that by his/~~her/their~~ signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature: C. Jones
Signature of Notary Public

Place Notary Seal Above

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

Description of Attached Document

Title or Type of Document: _____

Document Date: _____ Number of Pages: _____

Signer(s) Other Than Named Above: _____

Capacity(ies) Claimed by Signer(s)

Signer's Name: _____ Signer's Name: _____

☐ Corporate Officer — Title(s): _____ ☐ Corporate Officer — Title(s): _____

☐ Individual ☐ Individual

☐ Partner — ☐ Limited ☐ General ☐ Partner — ☐ Limited ☐ General

☐ Attorney in Fact ☐ Attorney in Fact

☐ Trustee ☐ Trustee

☐ Guardian or Conservator ☐ Guardian or Conservator

☐ Other: _____ ☐ Other: _____

Signer Is Representing: _____ Signer Is Representing: _____

RIGHT THUMBPRINT
OF SIGNER
Top of thumb here

RIGHT THUMBPRINT
OF SIGNER
Top of thumb here

Exhibit A-Scope of Work

Task 1: Project Management and Administration

Project Management- This task involves the coordination of project activities between the City of Durham and Tetra Tech's Project Managers for successful project completion. Tetra Tech's Project Manager will manage technical staff, project budget, and project schedule to ensure that the project is completed within budget and on time. Tetra Tech's Project Manager will prepare and submit an invoice and project status report monthly to the City Project Manager during the 7-month project duration as shown in Exhibit B. The invoice will provide the details and a summary of labor and direct expense charges by task, and an account summary. If Tetra Tech plans to purchase PCSWMM as part of this project budget, then such purchase shall be made on behalf of the City and be noted as such on the invoices and the license. Any license or usage rights retained by Tetra Tech shall be transferred to the City of Durham Stormwater Services upon completion of the project as a final deliverable.

The project status reports shall include an updated schedule, a summary of budget status that indicates overall percent spent by task and overall percent spent for the project, work progress, and any contract issues and their resolution. The monthly invoice and project status report should be submitted electronically (in pdf format). The final formats of invoice and monthly status report shall be approved by the City Project Manager prior to submittal of first report.

Tetra Tech's Project Manager and key technical leads will prepare for and attend a project kick-off meeting scheduled within two weeks after execution of this contract. A model transition or hand-off meeting with City's existing contractor, Brown and Caldwell, should also be scheduled within 1-2 weeks after execution of this contract.

Tetra Tech's Project Manager or QA/QC lead will ensure that all quality goals for the work products are met for entire duration of the project.

Deliverables for Task 1:

- Monthly project status reports and invoices
- Two meetings: (1) internal project kick-off with City (follow with brief email memo summary), and (2) a model transition meeting with Brown & Caldwell (follow with brief email memo summary)

Task 2: Gap analysis of existing PCSWMM model for Northeast Creek

The purpose of this task is to examine the initial modeling application developed in PCSWMM for Northeast Creek. Tetra Tech will conduct a gap analysis of hydrology and water quality data sources and periods used in the existing model. Any critical water quality parameters or processes that may be needed for modeling should be identified. This task will also include investigating the assumptions and processes used for hydrology and water quality parameterization in the initial model. This information should be compiled to make recommendations for enhancing the existing watershed model to generate more representative pollutant loads. This task should also evaluate PCSWMMs suitability for the TMDL development process.

The water quality constituents/parameters of concern for the purpose of this project are dissolved oxygen, turbidity, copper, zinc, total nitrogen (organic and inorganic), and total phosphorus. There will be two points of analysis for this modeling project that are the ambient monitoring stations maintained by the

Upper Cape Fear River Basin Association (UCFRBA). The first point of analysis for Northeast Creek modeling calibration and validation purposes will be at Sedwick Road (SR1102) upstream of the Triangle Wastewater Treatment Plant (WWTP). This is NCDWQ station number B3300000. Second point of analysis will be at another NCDWQ station number B3660000 at Grandale Drive (SR 1100), located below the WWTP in Durham County.

Deliverables for Task 2:

- Tetra Tech will meet with the City staff to discuss the results of Task 2
- A technical memorandum discussing initial modeling application developed in PCSWMM and critical data gaps identified that must be addressed for modeling results to support future TMDL development. Tetra Tech will provide a technical memorandum to receive input from the City and incorporate City suggestions in its approach and modeling QAPP as appropriate.

Requested Assistance or Data from City for Task 2:

At Notice to Proceed (NTP), the City will need to provide the following data/information:

- PCSWMM model and all associated spatial and land use data for Northeast Creek watershed developed by Brown and Caldwell
- All of City's relevant water quality monitoring data with accompanying quality assurance and sampling log information
- City spatial planimetric and impervious surface data
- City nutrient deposition monitoring data
- City data on location of Onsite Sewage Treatment Systems (OSTS) and failure rates
- City data on sanitary sewer system incidents, spills, repairs, etc.

Additionally, Tetra Tech and City will coordinate with Durham County to provide data on the wastewater treatment plant (WWTP) including obtaining discharge monitoring, instream monitoring, and relevant information on plant operations (i.e., any changes in treatment facilities, significant incidents potentially impacting instream water quality monitoring results, etc.).

Task 3: Hydrology and Water Quality Analysis and Modeling

Based on the recommendations from Task 2, Tetra Tech shall obtain additional hydrology and water quality data from different sources and for any new time periods. Tetra Tech shall determine which datasets will meet the regulatory criteria to be acceptable for future TMDL development prior to use in model development. Hydrologic calibration has been done as part of the initial modeling; Tetra Tech should investigate the need for re-calibrating hydrology based on new data sources and periods. Tetra Tech will perform water quality calibration, validation, and sensitivity analysis in PCSWMM for all parameters of concern except dissolved oxygen. The new and existing BMP scenarios developed in PCSWMM during the watershed plan development should be rerun with the upgraded model and pollutant removal should be reported. Low-flow conditions, seasonal variations, and any other critical conditions that may be of significance in developing a future TMDL for these parameters should also be evaluated.

Tetra Tech will attend a series of 3 meetings with the City staff and NCDWQ representatives to (1) discuss the intended approach early in the project, (2) to review and discuss interim progress midway through the project, and (3) present the results of Task 3. Since the progress meetings with NCDWQ will vary in their technical nature, Tetra Tech will coordinate with the City Project Manager to identify key team members for attending the meetings. Tetra Tech will provide the City Project Manager with a copy of presentations, handouts or any other material prepared for the meetings with NCDWQ at least one

week prior to the scheduled meeting. This will give the City staff an opportunity to review and provide feedback. This applies to all tasks where a meeting between City and NCDWQ is scheduled. Note that the three meetings will coordinate information from Tasks 3, 4, and 5 (i.e., there will not be separate meetings for each task).

Deliverables for Task 3:

- Tetra Tech will set up a webex or phone call with the City staff to discuss progress and information to be presented before each NCDWQ/City meeting associated with Tasks 3, 4 and 5.
- Tetra Tech will coordinate and attend three meetings with City and NCDWQ staff spread throughout the project to (1) discuss the intended approach early in the project, (2) to review and discuss interim progress midway through the project, and (3) present the results of Task 3. Tetra Tech will also prepare meeting minutes and distribute via email within one week of the meeting date.
- Tetra Tech will provide a technical memorandum discussing data collection, modeling assumptions, model calibration, validation, and results. Tetra Tech will provide a draft of the technical memorandum to receive input from the City and incorporate City suggestions when compiling the overall project final report.
- Tetra Tech will provide a calibrated and validated PCSWMM model for the parameters of concern, with the exception of dissolved oxygen.

Requested Assistance or Data from City for Task 3:

See data requests for Task 2; it is possible that after Task 2 gaps and recommendations are noted, that additional available information from the City will be requested.

Task 4- Dissolved Oxygen Modeling

Tetra Tech will develop a separate instream model for dissolved oxygen (DO) in Northeast Creek using Water Quality Analysis Simulation Program (WASP). A spatial representation of Northeast Creek should be created to select suitable upstream and downstream boundary conditions. Hydrology and other applicable data from calibrated and validated PCSWMM model should be used to support and parameterize the model. City has requested a sediment oxygen demand (SOD) study from NCDWQ. If NC DWQ decides to perform such a study, the results should be available for use in modeling by August 2012. Any water quality parameters specific to modeling dissolved oxygen that were identified during the gap analysis should be incorporated, if available. Tetra Tech will perform calibration and validation for WASP followed by a sensitivity analysis.

Task 4.1 (Optional Task) If additional data such as diurnal DO is needed, Tetra Tech should provide support for such, which will include a study plan in form of a Quality Assurance Project Plan (QAPP) and fieldwork in coordination with City staff. If City decides to pursue this optional task, it will be addressed as a contract amendment in an amount not to exceed \$9,305.

Deliverables for Task 4:

- Tetra Tech will set up a webex or phone call with the City staff to discuss progress and information to be presented before each NCDWQ/City meeting associated with Tasks 3, 4 and 5.
- Tetra Tech will attend three meetings with City and NCDWQ staff spread throughout the project to (1) discuss the intended approach early in the project, (2) to review and discuss interim progress midway through the project, and (3) present the results of Task 4.. Note that the three meetings will coordinate information from Tasks 3, 4, and 5 (i.e., there will not be separate

meetings for each task). Tetra Tech will also prepare meeting minutes and distribute via email within one week of the meeting date.

- Technical memorandum discussing the modeling methods and results. Tetra Tech will provide a draft of the technical memorandum to receive input from the City and incorporate City suggestions when compiling the overall project final report.
- Calibrated and validated WASP model capable of modeling DO in Northeast Creek. Files will be delivered at the end of the project.
- If Optional Task 4.1 is funded, technical support for data collection of other critical parameters such as diurnal DO data.

Requested Assistance or Data from City for Task 4:

Existing City water quality data have been requested under Task 2. However, it is noted that if additional data are needed to support calibration, the Tetra Tech will work with City staff to obtain the data. City time in planning and executing any additional monitoring will be required.

Task 5: Calculate allowable loads and determine spatial load distribution

Using the modeling results and pertinent watershed information gathered under Tasks 2-4, Tetra Tech will estimate pollutant loads for each jurisdiction (e.g., Durham City, Durham County, and Research Triangle Park) contributing to the study points of analyses described in Task 2. Loads should be determined for turbidity/total suspended solids, total copper, and total zinc from both point and nonpoint sources of pollution for each contributing jurisdiction. Similarly, allowable loads for dissolved oxygen should be developed using suitable parameters e.g., five-day biochemical oxygen demand (BOD₅) or ammonia. The point of analysis for determining northeast creek pollutant loads will be at the UCFRBA station at Sedwick Road. The methods to estimate allowable loads and margin of safety should be developed in consultation with NCDWQ.

Deliverables for Task 5:

- Tetra Tech will set up a webex or phone call with the City staff to discuss progress and information to be presented before each NCDWQ/City meeting associated with Tasks 3, 4 and 5.
- Tetra Tech will attend three meetings with City and NCDWQ staff spread throughout the project to (1) discuss the intended approach early in the project, (2) to review and discuss interim progress midway through the project, and (3) present the results of Task 5. Note that the three meetings will coordinate information from Tasks 3, 4, and 5 (i.e., there will not be separate meetings for each task). Tetra Tech will also prepare meeting minutes and distribute via email within one week of the meeting date.
- A technical memorandum summarizing the assumptions, methods, and results of determining point and non-point source loads for each contributing jurisdiction. Tetra Tech will provide a draft of the technical memorandum to receive input from the City and incorporate City suggestions when compiling the overall project final report.

Requested Assistance or Data from City for Task 5:

No special assistance or data other than that requested under Task 2 is thought to be needed at this time. However, it is possible that after Task 2 gaps and recommendations are noted, that additional available information from the City will be requested.

Task 6: Final Report

Tetra Tech will deliver a final project report describing in detail all the tasks identified above, and the methods used to attain the overall project goal and task-specific results. The technical memorandums generated for earlier tasks can be used to develop the final report. The report shall be submitted digitally as a single pdf file in a CD/DVD. The digital submission should also include full model set-ups for both PCSWMM and the WASP model with the input files, output files, calibration files, and water quality processing spreadsheets.

Task 7: WARMF Upgrade

The City Project Manager will assign a separate task manager for this optional task to whom Tetra Tech will report directly. As an optional task, Tetra Tech shall obtain and upgrade the NC DWQ watershed loading model calibrated in July of 2009 for the Falls Lake watershed.

A number of improvements to the model are desired to make the model more representative of the spatial distribution of City loads and to isolate Durham City/County nutrient loads from those of neighboring counties. The watershed model also offers a convenient method to track loads over time, including potential loads from smaller catchments that are not gauged. In order to facilitate these uses of the watershed model, Stormwater Services is seeking the following upgrades to the Falls Lake watershed application of the Watershed and Risk Management framework (WARMF):

- Add a map layer that includes county boundaries. Add a subwatershed to evaluate instream loads in the Eno River as it crosses into Durham County. This will involve additional watershed delineation within the Falls Lake application.
- Modify the Ellerbe, Little Lick and Lick Creek watersheds to create additional subwatersheds, as follows:
 - Ellerbe (Subcatchment ID 261). Separate South Ellerbe Creek and its drainage area from the upper Ellerbe Creek subwatershed. Include any necessary hydrography, consistent with the City hydrography, to enable instream fate and transport.
 - Little Lick (Subcatchment ID 453). Separate the Little Lick Creek subcatchment to create upper and lower Little Lick Creek subcatchments. The break point between the upper and lower subcatchments should be near Stallings Road. Include any necessary hydrography, consistent with the City hydrography, to enable instream fate and transport.
 - Lick (Subcatchment ID 454). Separate the Lick Creek subcatchment to create upper and lower Lick Creek subcatchments. The break point between the upper and lower subcatchments should be above Martin Branch. Include any necessary hydrography, consistent with the City hydrography, to enable instream fate and transport.
- Modify marker symbols. For ease of viewing, make the marker for meteorological stations a square and streamflow monitoring stations a triangle.
- Reduce the model time step to hourly. A test dataset can be used to ensure that core principles (e.g., continuity and conservation of mass) are maintained. A new model calibration is not considered part of the model upgrade.

Stormwater Services will provide geographic data to assist with the upgrade. The data anticipated to be available for this project includes the following: detailed hydrography for the Eno, Ellerbe, Little Lick and Lick Creek subwatersheds, major roads, and a digital elevation model. All geographic data will be compatible with ArcGIS v9.3.1. Subwatershed delineations should be reviewed by the Task Manager.

Deliverables for Task 7:

- Tetra Tech shall provide three compact discs with the modified WARMF application to the Falls Lake watershed.

Requested Assistance or Data from City for Task 7:

It is assumed that within one week from NTP, Tetra Tech will be able to obtain the WARMF model and associated files from NCDWQ. It is possible that the City may be called upon to verify to NCDWQ of the intended use of the model on behalf of the City of Durham.

Also within one week from NTP, the City will provide Tetra Tech with geographic data to assist with the WARMF model upgrade. The data anticipated to be available for this project includes the following: detailed hydrography for the Eno, Ellerbe, Little Lick and Lick Creek subwatersheds, current jurisdictional boundaries, major roads, and a digital elevation model.

Exhibit B-Project Schedule

Proposed Tetra Tech Project Schedule for the Northeast Creek Modeling Services Project (Revised 6-11-12)

Task	Task Description	Time Period																												
		2012							2013																					
		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Notice to Proceed = Aug 20, 2012																													
1.0	Project Management																													
	Project invoices and written work summaries																													
	Meetings (1 internal kickoff, 1 model transition with Brown & Caldwell)																													
2.0	Watershed Model Gap ID and Characterization Recommendations																													
a.	Conduct evaluation and draft memo for City review																													
b.	Meeting to discuss results and City comment period																													
3.0	SWMM Model Setup, Calibration, and Validation																													
a.	Data collection and processing																													
b.	Internal model QAPP development																													
c.	SWMM model setup, calibration and validation, sensitivity analysis																													
d.	Revised Northeast Creek WMP development scenarios with BMPs																													
e.	Task 3 items: draft memo																													
f.	Discussions with City followed by Joint City/DWQ/TI meetings																													
g.	Model delivery (coordinated with final report and DO model delivery)																													
4.0	WASP Model Setup, Calibration, and Validation																													
a.	Internal model QAPP development																													
b.	Preliminary Model Setup																													
c.	Model calibration and validation																													
d.	Task 4 items: draft memo																													
e.	Discussions with City followed by Joint City/DWQ/TI meetings																													
f.	Model delivery (coordinated with final report and DO model delivery)																													
5.0	Spatial Load Allocation Development																													
a.	Maps illustrating spatial load distribution																													
b.	Discussions with City followed by Joint City/DWQ/TI meetings																													
c.	Written summary of load allocation process and results (coordinate with final rep)																													
6.0	Results Presentation and Final Report Development																													
a.	Draft report on model calibration and validation																													
b.	Final report																													
7.0	Falls Lake WARIF Model Application																													
a.	Draft delineation of subcatchments for WARIF, and City review																													
b.	Complete county boundary layer, final subcatchments and model revisions																													
c.	Evaluation of WARIF reduced timestep																													
d.	Conference call to discuss WARIF results																													
e.	Delivery of memo summarizing changes, and compact discs with modified apps																													
	delivery date or anticipated meeting time frame																													
	indicates tentative timeframe for Joint City/DWQ/TI meetings																													
	Tetra Tech time frame																													
	City of Durham allocated review or acceptance period																													





 delivery date or anticipated meeting time frame
 indicates tentative timeframe for joint City/DWQ/TI meetings
 Tetra Tech time frame
 City of Durham allocated review or acceptance period

Exhibit C-Project Team and Key Personnel

